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5∃ Name of Invention: **ROAD MARKING MATERIAL**

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Detailed Description

1. Name of Invention
Road Marking Material

2. Scope of Patent Applied
(1) A road marking material featuring 1-50pts.wt. bisamide with an m.p. of 110-160°C mixed with 100pts.wt. binder resin as its primary ingredients.

3. Detailed Explanation of Invention
(Applicable Field of Industry)
This invention relates to road marking materials.

(Traditional Techniques)
Traditional melting type road marking materials are designed based on seasonal temperature (outdoor temperature, road surface temperature) conditions, road surface conditions, trafficability, time open for traffic, etc. For example, in summer when the outdoor temperature rises, the time open for traffic and resulting stains became highly problematic. Summer standard

compounds, made with increased binder resin and decreased plasticizer, is designed to dry faster with consideration for stain resistance. As a result, using the summer standard compound in winter can cause cracks, and make it impossible to use it during the cold season.
On the other hand, in winter when the outdoor temperature falls, there is a concern for cracks due to chilling, so the amount of plasticizer must be increased. By doing so the composition could not be used in summer when the dryability and the stain resistance should not be compromised.

(Problem To Be Solved By This Invention)
Therefore in the past it was assumed that material compounds should be designed, manufactured and applied corresponding to seasonal changes. Devising a road marking material that can be used all year round, which can offer great advantages in manufacturing, application and quality is desired.
This invention is a result of diligent work, and numerous trials and errors designed to solve the above problem. Its purpose is to offer a well-balanced road marking material compound that is superior in dryability, stain resistance, and in preventing cracks.

(Means To Solve the Problem)
This invention refers to a road marking material which features 1-50pts.wt. bisamide of an m.p. 110 - 160°C mixed with 100pts.wt. binder resin.
The bisamide used in this invention is a widely recognized compound, which can be obtained by condensation of an acid and an amine, and is a white wax-like compound with a high m.p.

As for the acids, long chain fatty acids are used, such as oleic acid, behenic acid, stearic acid, lauric acid and sebacic acid.

As for the amines, aliphatic amines such as methylene diamine, ethylene diamine, trimethylene diamine, tetramethylene diamine, pentamethylene diamine, hexamethylene diamine, 1,7-diamino-heptane, 1,8-diamino-octane, 1,9-diamino-nonane, 1,10-diamino-decane are used.

The most preferred combinations for producing the road marking material for this invention, are etylenebislaurinamide with an m.p. of 157°C obtained from lauric acid and ethylene diamine, hexamethylenebisstearic acid amide with an m.p. of 146°C obtained from stearic acid and hexamethylene amide, and ethylenebisstearic acid amide with an m.p. of 143°C obtained from stearic acid and ethylenediamine. Aromatic bisamides may be used (i.e. m-xylene bisstearic acid amide, N,N'-disstearoylisophthalic acid amide or N,N'-disstearoylterephthalic acid amide) but they are not as weather-resistant as aliphatic bisamides. As for the mixing ratio, it is ideal to have 100pts.wt. binder resin mixed with 1 ~ 50 pts.wt. of the disamide; preferably 5 ~ 30 pts.wt.

When it is less than 1 pts.wt. the dryability and stain resistance are compromised, and when it becomes more than 50 pts.wt., it cannot prevent cracks from occurring under lower temperature.

The m.p. of the bisamide used for this invention is 110 ~ 160°C. When the m.p. is lower than 110°C, it does not show any sign of improvement in dryability and heat resistance. Should it be higher than 160°C, the material fails to prevent cracks under low temperatures.

Ordinary materials available in the market will be acceptable for the other ingredients in this invention.

When it comes to the binder resin, one or more resins can be used together including raw rosin, maleic acid rosin, maleic acid rosin ester, hydrogenation resins thereof, petroleum resin, polyamide resin, saturated polyester resin and xylene resin.

It is ideal for the mixing ratio of the binder resin to be 10 ~ 20wt.% of the total weight of the road marking material. When the binder resin content is less than 10wt.% of the total, fluidity and binding strength of the road marking material tend to be poor. When the content is more than 20wt.% of the total, stain resistance becomes poor although the fluidity and binding strength are satisfactory.

As for the plasticizer, any one of the following can be used either alone or in combination: vegetable oil, vegetable oil modified alkyd resin, mineral oil, phthalic acid ester compounds, epoxy oil and liquified synthetic rubber. The mixing ratio of plasticizer is considered ideal when it is 0.5 ~ 5wt.% of the road marking material's total weight. If the mixing ratio falls below 0.5wt. %, it will be inferior in binding strength, preventing cracks under lower temperature and fluidity, but if the mixing ratio exceeds 5wt%, stain resistance and dryability will be reduced.

Concerning coloring pigments, titanium dioxide, zinc white, lithopone and white lead are mainly chosen for white coloring; and chrome yellow (heat-resistant chrome yellow), organic yellow pigment, titanium yellow and yellow iron oxide are main choices for yellow coloring. The mixing ratio is ideal if such pigments are 1 ~ 10wt.% of the total weight of the road marking material. If the pigments make up less than 1wt.%, the coloring power and/or opacity become less and visibility will be poor. If it is to exceed 10wt.%, it can provide satisfactory visibility and the addition of more no longer enhances visibility, but only inflates the cost.

In addition, calcium carbonate, silicon dioxide, white (Japanese) marble, glass beads and alumina are used either alone or combined as the inorganic filler, with an ideal mixing ratio of 40 ~ 65wt.% of the road marking material's total weight. When the ratio is less than 40wt.%, resistance to stains and wear can be compromised, and when it is more than 65wt.%, cracks under lower temperatures will be increased and binding strength will be reduced.

As the reflecting material, glass beads, as specified in JIS K 5665 (glass beads of JIS R 3301) should be 15 ~ 30wt.% of the total weight of the road marking material.

Auxiliary additives such as a sedimentation inhibitor or an antioxidant may also be used.

All the above ingredients are blended in a mixer to make a road marking material.

In this invention the above mixture can be filled in a soluble bag (the bag will dissolve) for use.

(Examples)

Following are some examples of this invention but its application will not be limited to the examples. It must be noted that "pts." used in the examples refer to "pts.wt." unless otherwise described.

Test 1.

a. Slippax (m.p. 157°C) --- 1.5 pts.
   (Ethylenebisstearamide, a product made by Japan Chemical)
b. Binder Resin --- 1.5 pts.
   (Acid denatured aliphatic petroleum resin Quinton C-200S by Japan Zeon)
c. Plasticizer --- 3 pts.
   (Soybean oil denatured alkyd resin FT280-100 by Hitachi Chemical)
d. Coloring Pigment --- 5pts.wt.
   (Titanium dioxide)
e. Inorganic Filler --- 59.5 pts.
   (Calcium carbonate/White marble = 1/1 pts.wt.)
f. Reflecting Material --- 16 pts.
   (Glass beads of diameter 0.105 ~ 0.84mm)

After all the above ingredients a ~ f were thoroughly combined in a mixer, the mixture was poured into a vehicle loading type kneeder and melted, which was then applied to the asphalt surface at 180 ~ 200°C to become 1.5 ~ 1.7mm thick.

After the application, drying speed, stain resistance and cracks (including days afterward) were examined and results are shown in Chart-1 (Testing conditions were the outdoor temperature at 30°C and the road surface temperature at 45°C).

Test 2.

a. Slippax E (m.p. 143°C) --- 3 pts.
   (Ethylenebissteramide, product by Japan Chemical)
b. Binder Resin --- 15 pts.
   (Acid denatured aliphatic petroleum resin Quinton C-200S by Japan Zeon)
c. Plasticizer --- 3 pts.
   (Soybean oil denatured alkyd resin FT280-100 by Hitachi Chemical)
d. Coloring Pigment --- 5 pts.
   (Titanium dioxide)
e. Inorganic Filler --- 58 pts.
   (Calcium carbonate/White marble = 1/1 wt.)
f. Reflecting Material --- 16 pts.
   (Glass beads of diameter 0.105 ~ 0.84 mm)

All the above ingredients a ~ f were combined as Test 1 above, melted and then applied for testing. The results are given in Chart-1.

Comparative Test 1. (Traditional product for summer)

a. Binder Resin --- 15 pts.
   (Acid denatured aliphatic petroleum resin Quinton C-200S by Japan Zeon)
b. Plasticizer --- 1.5 pts.
   (Soybean oil alkyd resin FT280-100 by Hitachi Chemical)
c. Coloring Pigment --- 5 pts.
   (Titanium dioxide)
d. Inorganic Filler --- 62.5 pts.
   (Calcium carbonate/White marble = 1/1 wt.)
e. Reflecting Material --- 16 pts.
   (Glass beads of diameter 0.105 ~ 0.84 mm)

All the above ingredients a ~ f /sic/ were mixed in the same manner as Test 1, melted, applied to road surface and examined. The results are shown in Chart-1.

Comparative Test 2. (Traditional product for winter)

a. Binder Resin --- 14 pts.
   (Acid denatured aliphatic petroleum resin Quinton C-200S by Japan Zeon)
b. Plasticizer --- 2.5 pts.
   (Soybean oil alkyd resin FT280-100 by Hitachi Chemical)
c. Coloring Pigment --- 5pts.
   (Titanium dioxide)
d. Inorganic Filler --- 62.5 pts.
   (Calcium carbonate/White marble = 1/1 wt.)
e. Reflecting Material --- 16 pts.
   (Glass beads of diameter 0.105 ~ 0.84 mm)

All the above ingredients a ~ f /sic/ were mixed in the same manner as Test 1, melted, applied to road surface and examined. The results are shown in Chart-1.

Chart-1. Test Results

Test Item		Test 1.	Test 2.	Comparative Test 1.	Comparative Test 2.
Drying Time		2 min.	2 min.	1min. 45sec.	4 min.
Stain Resistance		O	O	O	X
Cracks	After 1 month	O	O	X	O
	After 3 months	O	O	X X	O
	After 6 months	O	O	X X	O

(Testing Method)
Drying Time --- Time needed to dry enough after application till there were no tire markings.
Stain Resistance --- Condition of markings after respective drying time followed by the application, a 3.5ton vehicle went and returned 30 times.

O --- No stains

X --- Stained black overall

Cracks --- The road surface was checked each 1 month, 3 months and 6 months after the markings were applied.

O --- No cracks found

X --- 1~3 cracks / 5m

X X --- More than 4 cracks / 5m

(Efficiency of This Invention)

The road marking material obtained by this invention is highly effective as can be seen from the test results above with excellent dryability and stain resistance and is well-balanced when crack reduction is added to the consideration. Thus it is a highly useful material that can be applied regardless of the season, which proves to be quite efficient both from manufacturing and application points of view.

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